II. Amendments to the Claims

This listing of claims replaces without prejudice all prior versions and listings of claims in the application:

Listing of Claims:

1. (currently amended) A multi-channel spectrum analyzer with a plane transmission diffraction grating, comprising:

   a. polychromatic radiation collecting and delivery elements adapted to collect polychromatic radiation simultaneously from a plurality of points of one or more sources of electromagnetic radiation and to deliver the polychromiatic raditation in the form of a spatial distribution of the polychromatic radiation to a spectrum disperser;

   b. ~~a~~ the spectrum disperser coupled to said polychromatic radiation collecting and delivery elements for transmitting polychromatic radiation, the spectrum disperser comprising

      i. an entry port,

      ii. a composite achromatic collimating lens for transforming divergent beams of polychromatic radiation ranging between wavelengths λ_1 and λ_2 emerging from each point of the entry port into collimated polychromatic beams,

      iii. a transmission diffraction grating for transforming each collimated polychromatic beam ~~from~~ produced by the ~~first~~ composite achromatic

collimating lens into a fan of diffracted collimated monochromatic beams, each diffracted collimated monochromatic beam having a wavelength ranging between said wavelengths λ_1 and λ_2, and

iv. a composite focusing objective to transform each diffracted collimated monochromatic beam in each fan into a separate spot of radiation of a flat spectral image;

c. a photodetector array placed in the plane of the flat spectral image for ~~collecting~~ detecting radiation transmitted by the spectrum disperser and converting said radiation transmitted by the spectrum disperser into an electric signal.

2. (currently amended) The analyzer of claim 1, wherein a spectral working band of the spectrum disperser, ranging between said wavelengths λ_1 and λ_2, is within a spectral range of about 400nm to about 2500nm.

3. (currently amended) The analyzer of claim 1, wherein for an angular span □. of beams entering the objective with a spectral band whose shortest wavelength is □$_1$ and longest wavelength is □$_2$, wherein ratio r is equal to □$_2$/□$_1$, the analyzer comprises a plane diffraction grating having a linear diffraction structure with period given by formula

$$d = \frac{\sqrt{(\lambda_2 - \lambda_1)^2 + (\lambda_2 + \lambda_1)^2 \cdot tg^2\left(\delta/4\right)}}{2 \cdot \sin\left(\delta/2\right)},$$

wherein for a given ratio r, the normal to the surface of the grating creates with the axis of an incident polychromatic beam an angle α, independent on position

of the working band in electromagnetic spectrum, and given by the formula

$$\alpha = atg\left[\frac{(r+1)}{(r-1)} \cdot tg\left(\frac{\delta}{4}\right)\right],$$

and wherein the fringes of the linear diffraction structure of the grating are perpendicular to the plane determined by the normal to the surface of the grating and the axis of the incident beam.

4. (currently amended) The analyzer of claim 1, wherein the polychromatic radiation collection and delivery elements comprise a plurality of fiber optic radiation guides for transmitting collected polychromatic radiation.

5. (currently amended) The analyzer of claim 4, wherein at least one radiation guide is coupled to at least one performance enhancing element, at one or more ends thereof, wherein each performance enhancing element is selected from the following group: a lens, a micro-lens, a mirror, a graded-index lens, and a diffractive optical element.

6. (original) The analyzer of claim 4, wherein at least one radiation guide is coupled to at least one radiation controlling element, at one or more ends thereof.

7. (original) The analyzer of claim 4, wherein the plurality of radiation guides are coupled to a terminator element to arrange said guides along a straight line.

8. (original) The analyzer of claim 1, further comprising calibration elements for producing a wavelength calibration signal.

9. (currently amended) The analyzer of claim 8, wherein said calibration elements are adapted to receive radiation from at least one wavelength calibration sources, and transmit said radiation within at least a single fiber optic radiation guide.

10. (currently amended) The analyzer of claim 1, wherein said composite focusing objective comprises ~~three~~ two positive thin lenses and a negative thick lens, wherein the negative thick lens is positioned between the two positive thin lenses, and the specific relative thickness of the negative thick lens, calculated as the ratio of its thickness to the focal length of the composite focusing objective is about 0.404, the equivalent focal length of the composite focusing objective is about 105.03 mm, the relative focal length of the first thin positive lens is about 0.457, and the relative focal lengths of the negative thick lens and each positive thin lens are about -0.188 and about 0.403 respectively.

11. (original) The analyzer of claim 10, wherein said composite focusing objective comprises two positive thin lenses and a negative thick lens, wherein the negative thick lens is positioned between the two positive thin lenses.

12. (original) The analyzer of claim 11, wherein each positive thin lens is composed of a material having a refractive index between about 1.60 and about 1.62 and an Abbe number between about 58 and about 59, and wherein the negative

thick lens is composed of a material having a refractive index between about 1.66 and about 1.68 and an Abbe number between about 31 and about 33.

13. (original) The analyzer of claim 11, wherein the ratio of the axial thickness of the negative thick lens to the focal length of the composite focusing objective is between about 0.38 and about 0.42.

14. (original) The analyzer of claim 11, wherein the ratio of the focal length of one positive thin lens to the focal length of the composite focusing objective is between about 0.45 and about 0.47.

15. (original) The analyzer of claim 11, wherein the ratio of the focal length of the negative thick lens to the focal length of the composite focusing objective is between about -0.18 and about -0.20.

16. (original) The analyzer of claim 11, wherein the ratio of the focal length of one positive thin lens to the focal length of the composite focusing objective is between about 0.39 and about 0.41.

17. (original) The analyzer of claim 11, wherein the two positive thin lenses are composed of the same material, and wherein the negative thick lens is composed of a material different from the material of the two positive thin lenses.

18. (currently amended) The analyzer of claim 1, wherein the array is positioned within the analyzer to perform simultaneous registration of spectral composition of polychromatic radiation ranging between wavelengths λ_1 and

λ_2 diffracted by the transmission diffraction grating and emerging from ~~every~~ each point of the entry port ~~a slit~~.

19. (cancelled).

20. (currently amended) A spectrum disperser for a multi-channel spectrum analyzer, the spectrum disperser ~~adapted~~ for coupling to polychromatic radiation collecting and delivery elements adapted to collect polychromatic radiation simultaneously from a plurality of points of one or more sources of electromagnetic radiation and to deliver the polychromatic radiation in the form of a spatial distribution of the polychromatic radiation to the spectrum disperser, ~~for transmitting radiation, the spectrum disperser for use in the analyzer of claim 1,~~ the spectrum disperser comprising:

    i. an entry port,
    ii. a composite achromatic collimating lens for transforming divergent beams of polychromatic radiation ranging between wavelengths λ_1 and λ_2 emerging from each point of the entry port into collimated polychromatic beams,
    iii. a transmission diffraction grating for transforming each collimated polychromatic beam ~~from~~ produced by the ~~first~~ composite achromatic collimating lens into a fan of diffracted collimated monochromatic beams, each diffracted collimated monochromatic beam having a wavelength ranging between said wavelengths λ_1 and λ_2, and
    iv. a composite focusing objective to transform each diffracted collimated monochromatic beam

in each fan into a separate spot of radiation of a flat spectral image.

21. (new) The analyzer of claim 1, wherein the normal to the surface of the transmission diffraction grating creates with the axis of an incident polychromatic beam an angle α as determined by the equation

$$\alpha = atg\left[\frac{\lambda_2 + \lambda_1}{\lambda_2 - \lambda_1} \cdot tg\left(\frac{\delta}{4}\right)\right]$$

wherein δ is the angle between the diffracted directions of radiation λ_1 and λ_2.